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PCT/KR2005/000038

PATENT COOPERATION TREATY

PCT

INTERNATIONAL PRELIMINARY REPORT ON PATENTABILITY

(Chapter II of the Patent Cooperation Treaty)

(PCT Artcle 36 and Rule 70)

Applicant's or agent's file reference OP-0153	FOR FURTHER ACTION	See Form PCT/IPEA/416
International application No. **PCT/KR2005/000038**	International filing date *(day/month/year)* **07 JANUARY 2005 (07.01.2005)**	Priority date *(day/month/year)* 28 FEBRUARY 2004 (28.02.2004)

International Patent Classification (IPC) or national classification and IPC

C08K 7/10(2006.01)i

Applicant

KOREA UNIVERSITY INDUSTRY AND ACADEMY COOPERATION FOUNDATION et al

1. This report is the international preliminary examination report, established by this International Preliminary Examining Authority under Article 35 and transmitted to the applicant according to Article 36.
2. This REPORT consists of a total of 4 sheets, including this cover sheet.
3. This report is also accompanied by ANNEXES, comprising:
   a. ☐ (sent to the applicant and to the International Bureau) a total of _____ sheets, as follows:
      ☐ sheets of the description, claims and/or drawings which have been amended and are the basis for this report and/or sheets containing rectifications authorized by this Authority (see Rule 70.16 and Section 607 of the Administrative Instructions).
      ☐ sheets which supersede earlier sheets, but which this Authority considers contain an amendment that goes beyond the disclosure in the international application as filed, as indicated in item 4 of Box No. I and the Supplemental Box.
   b. ☐ *(sent to the International Bureau only)* a total of (indicate type and number of electronic carrier(s)) _____, containing a sequence listing and/or tables related thereto, in electronic form only, as indicated in the Supplemental Box relating to Sequence Listing (see Section 802 of the Administrative Instructions).

4. This report contains indications relating to the following items:
   - ☒ Box No. I Basis of the report
   - ☐ Box No. II Priority
   - ☐ Box No. III Non-establishment of opinion with regard to novelty, inventive step and industrial applicability
   - ☐ Box No. IV Lack of unity of invention
   - ☒ Box No. V Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement
   - ☐ Box No. VI Certain documents cited
   - ☐ Box No. VII Certain defects in the international application
   - ☐ Box No. VIII Certain observations on the international application

Date of submission of the demamd	Date of completion of this report
05 OCTOBER 2005 (05.10.2005)	09 MAY 2006 (09.05.2006)
Name and mailing address of the IPEA/KR Korean Intellectual Property Office 920 Dunsan-dong, Seo-gu, Daejeon 302-701, Republic of Korea Facsimile No. 82-42-472-7140	Authorized officer PARK, Ham Yong Telephone No. 82-42-481-8409

Form PCT/IPEA/409 (cover sheet) (April 2005)

INTERNATIONAL PRELIMINARY REPORT ON PATENTABILITY

International application No.
PCT/KR2005/000038

Box No. I Basis of the report

1. With regard to the **language,** this report is based on the international application in the language in which it was filed, unless otherwise indicated under this item.

   ☒ This report is based on translations from the original language into the following language English, which is the language of a translation furnished for the purposes of:

   ☐ international search (under Rules 12.3 and 23.1(b))
   ☒ publication of the international application (under Rule 12.4)
   ☐ international preliminary examination (under Rules 55.2 and/or 55.3)

2. With regard to the **elements** of the international application, this report is based on *(replacement sheets which have been furnished to the receiving Office in response to an invitation under Article 14 are referred to in this reort as "originally filed" and are not annexed to this report):*

   ☒ the international application as originally filed/furnished

   ☐ the description:
   pages _____ as originally filed/furnished
   pages* _____ received by this Authority on _____
   pages* _____ received by this Authority on _____

   ☐ the claims:
   pages _____ as originally filed/furnished
   pages* _____ as amended (together with any statment) under Article 19
   pages* _____ received by this Authority on _____
   pages* _____ received by this Authority on _____

   ☐ the drawings:
   pages _____ as originally filed/furnished
   pages* _____ received by this Authority on _____
   pages* _____ received by this Authority on _____

   ☐ the sequence listing and/or any related table(s) - see Supplemental Box Relating to Sequence Listing.

3. ☐ The amendments have resulted in the cancellation of:
   ☐ the description, pages _____
   ☐ the claims, Nos. _____
   ☐ the drawings, sheets _____
   ☐ the sequence listing *(specify)* : _____
   ☐ any table(s) related to sequence listing *(specify)* : _____

4. ☐ This report has been established as if (some of) the amendments annexed to this report and listed below had not been made, since they have been considered to go beyond the disclosure as filed, as indicated in the Supplemental Box (Rule 70.2(c)).
   ☐ the description, pages _____
   ☐ the claims, Nos. _____
   ☐ the drawings, sheets _____
   ☐ the sequence listing *(specify)*: _____
   ☐ any table(s) related to sequence listing *(specify)* : _____

** If item 4 applies, some or all of those sheets may be marked "superseded."*

INTERNATIONAL PRELIMINARY REPORT ON PATENTABILITY

International application No.
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Box No. V Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement

1. Statement

Novelty (N)	Claims	1-23	YES
	Claims	None	NO
Inventive step (IS)	Claims	17, 21-23	YES
	Claims	1-16, 18-20	NO
Industrial applicability (IA)	Claims	1-23	YES
	Claims	None	NO

2. Citations and explanations (Rule 70.7)

1) Reference is made to the following documents:

D1: KR 10-2002-95380 A (26.12.2002)

D2: Kim, B.K. et al., Euro: Polym. J. 39, 85-91 (2003)

D3: Hu, J. et al., Colloid Polym. Sci. 279, 819-822 (2001)

D4: US 2003-50354 A1 (13.3.2003)

2) Novelty

Claims 1-23 meet the requirement of PCT Article 33(2).

3) Inventive Step

Claims 1-3 and 7 of the present invention relate to a nanocomposite comprising polyurethane and clay that is covalently bonded to a typical diisocyanate. Claim 4 defines that the clay is further treated with acid, alkylammonium ion or alkylphosphonium ion.

D1 discloses that clay is treated with an inorganic acid and silanol group on clay interlayer surface can be further reacted with amine, fatty acid or isocyanate. Furthermore D1 indicates that clay modified with such organic compounds is used to prepare polymer/clay nanocomposite. An exemplar of polyurethane/clay nanocomposite is also disclosed in page 4, describing that diisocyanate, ethylene oxide/propylene oxide, and acid-treated clay are altogether mixed and reacted to prepare polyurethane/clay nanocomposite.

Comparing D1 with claims 1-4 and 7, the proportion of diisocyanate and clay in claim 1 is not disclosed in D1, however, it is obvious that the amount of clay regarding to clay can be arbitrarily selected to make polymer/clay nanocomposite. Also, any particular technical features to select a specific type of clay are not found in this invention. Therefore the subject matter of claims 1-4 and 7 lacks an inventive step.

(Continued on Supplemental Box..)

Supplemental Box

In case **the space in any of the preceding boxes is not sufficient.**
Continuation of:

Box V.

Dependent claims 5, 6 and 11 of the present invention define specific components of polyol and chain extender. D2 discloses waterborne polyurethane/clay nanocomposite comprising poly(tetramethylene glycol),. poly(butylene adipate) diol as a polyester polyol, 1,4-butanediol as a chain extender, isophorone diisocyanate, and a catalyst. D3 also discloses polyurethane/clay nanocomposite comprising organophilic montmorillonite, diisocyanate, polyol and chain extender. Obviously, a skilled person in the art can readily anticipate this invention by combining the nanocomposite in D1 and the polyol in D2 or D3. Therefore the subject matter of claims 5, 6 and 11 lacks an inventive step.

Dependent claims 8-10 and 12 relate to a nanocomposite having additional features of a foaming agent and flame retardant. However D4 discloses a polyurethane foam composition comprising a polyisocyanate component, an active hydrogen-containing component, a catalyst, a surfactant, a flame retardant as essential components, and optionally exfoliated nanoclay(CLOISITE 20A). In the case of the combination of D1 and D4, the subject matter of claims 8-10 and 12 seems to be obvious to the skilled person in the art.

Claims 13-16 and 18-20 relate to a method of preparing polyurethane/clay nanocomposite. However, the steps of a) mixing diisocyanate and clay, b) making covalent bonding between diisocynate and silanol groups of clay, c) preparing polyurethane/clay nanocomposite of the present invention are altogether disclosed in D1. Reaction temperature and the ratio of NCO/OH are also disclosed. A feature of adding a catalyst in step c) is disclosed in D2, revealing that an amine-containing basic catalyst is added to prepare polyurethane/clay nanocomposite.

Thus the subject matter of claims 13-16 and 18-20 lacks an inventive step.

Therefore, claims 1-16 and 18-20 do not involve an inventive step under PCT 33(3).

4) Industrial Applicability
Claims 1-23 are considered to be industrially applicable.